CLAIMS

I claim:

1. An improved apparatus for wind powered transportation comprising:

transportation means;

single layer, inherently stable and powerful aerodynamic means capable of flying without surface discontinuity, bridles, or rigid structure and having a centerline, wingtips, and a tail corner;

attachment means linking aerodynamic means to transportation means whereby aerodynamic means function and transportation means motion are thereby controlled.

2. The apparatus of claim 1, wherein the aerodynamic means further comprises a light weight, three dimensional wing comprising a plurality of gores of predetermined geometries, and defining a large diameter self-supporting rolled-over leading edge of an airfoil, a trailing edge, a nose, an inside windward surface, and an outside leeward surface, wherein all stresses within the wing resulting from aerodynamic forces, gravity, and transient forces due to inertia are converted into tensile stress within the wing and into pure tension transferred to the attachment means, and wherein the wing profile of the wing approaching the trailing edge exhibits increasing convexity.

3. The apparatus of claim 1, wherein the aerodynamic means further comprises a molded single continuous sheet of material, defining a large diameter self-supporting rolled-over leading edge of an airfoil, a trailing edge, a nose, wingtips, tail corner, an inside windward surface, and an outside leeward surface, wherein all stresses within the wing resulting from aerodynamic forces, gravity, and transient forces due to inertia are converted into tensile stress within the wing and into pure tension transferred to the attachment means, and wherein the wing profile of the wing approaching the trailing edge exhibits increasing convexity.

4. The apparatus of claims 2 or 3, wherein the attachment means further comprises a least one flexible line with two ends, one end affixed to the transportation means and the other end affixed to the aerodynamic means.

5. The apparatus of claims 2 or 3, wherein the attachment means further comprises three flexible lines, each line comprising two ends, wherein three line ends are affixed to specific control points on the transportation means and the other three line ends are affixed to the aerodynamic means at unique points on the periphery of the wing.

6. The apparatus of claims 4 or 5, wherein the transportation means consists of watercraft, marine structures, skis, sail

boards, land vehicles, dirigibles, aircraft, satellites, space craft, and nano-scale vehicles.

7. The apparatus of claim 6, wherein the flying lines further define three axes in relation to the wing and transportation means, and wherein roll and pitch, attitude, altitude, flying speed, angle of attack, internal pressure, and gross shape of the wing, and airflow within, are controlled by independent manipulation of flying line length.

8. The apparatus of claim 7, wherein the aerodynamic means further comprises at least one variously shaped and sized enclosure containing a lighter than air gaseous mixture.

9. The apparatus of claim 8, wherein each enclosure is torpedo shaped comprising a lightweight, gas impermeable material attached to the kite's centerline or near its nose on the kite's inside surface, and wherein the kite is rendered neutrally or negatively buoyant in air by the enclosure(s).

10. The apparatus of claim 9, wherein the aerodynamic means comprises at least two conjoined vaults or lobes of material with a projecting angle, or groin, between the two characteristically running partly or completely along the centerline.

11. An improved apparatus for wind assisted watercraft comprising:

watercraft means comprising sail handling means;

a single layer, inherently stable and powerful light weight, three dimensional wing having a centerline, wingtips, and a tail corner;

three flexible flying lines of predetermined adjustable length each comprising two ends, wherein for each flying line one end is affixed to a unique point on the periphery of the wing and the other end is affixed to the sail handling means.

12. The apparatus of claim 11, wherein the three dimensional wing further comprises a plurality of gores of predetermined geometries, defining a large diameter self-supporting rolled-over leading edge of an airfoil, a trailing edge, a nose, an inside windward surface, and an outside leeward surface, wherein all stresses within the wing resulting from aerodynamic forces, gravity, and transient forces due to inertia are converted into tensile stress within the wing and into pure tension transferred to watercraft means via the flying lines, and wherein the wing profile of the wing approaching the trailing edge exhibits increasing convexity.

13. The apparatus of claim 11, wherein the three dimensional wing further comprises molded single continuous sheet of material, defining a large diameter self-supporting rolled-over leading edge of an airfoil, a trailing edge, a nose, an inside windward surface, and an outside leeward surface,

wherein all stresses within the wing resulting from aerodynamic forces, gravity, and transient forces due to inertia are converted into tensile stress within the wing and into pure tension transferred to watercraft means the flying lines, and wherein the wing profile of the wing approaching the trailing edge exhibits increasing convexity.

14. The apparatus of claims 12 or 13, wherein the flying lines further define three axes in relation to the wing and watercraft means, and wherein roll and pitch, attitude, altitude, flying speed, angle of attack, internal pressure, and gross shape of the wing, and airflow within, are controlled by independent manipulation of flying line length.

15. The apparatus of claim 12, wherein the plurality of gores are secured and connected to form the three dimensional wing by first adhesively securing jointures between edge-to-edge gores using double-sided adhesive means, then sewn using flat overlapping seams and a zigzag sewing stitch.

16. The apparatus of claim 14, wherein the three dimensional wing further comprises at least one variously shaped and sized enclosure containing a lighter than air gaseous mixture.

17. The apparatus of claim 16, wherein each enclosure is torpedo shaped comprising a lightweight, gas impermeable material

attached to the wing's centerline or near its nose on the wing's inside surface, and wherein the wing is rendered neutrally or negatively buoyant in air by the enclosure(s).

18. The apparatus of claim 17, wherein the aerodynamic means or wing comprises two conjoined vaults or lobes of material with a projecting angle, or groin, between the two characteristically running partly or completely along the centerline.

19. A method of constructing the aerodynamic means of claim 1 or the wing of claim 11, the method comprising the steps of:

providing a plurality of gores;

cutting the gores into shapes which will stretch into shapes consistent with the desired shape of the aerodynamic means or wing;

attaching the gores to each other, edge-to-edge within the desired shape of the aerodynamic means or wing;

securing the jointures between edge-to-edge gores;

reinforcing the edges of the resulting structure of the aerodynamic means or wing;

reinforcing the corners of the resulting structure of the aerodynamic means or wing;

reinforcing the interior seams of the resulting structure of the aerodynamic means or wing;

providing attachment points at the corners;

providing reinforcement patches as necessary for attachment of launching/retrieval lines; and

trimming any excess material to conform to the desired shape of the aerodynamic means or wing.

20. The method of claim 19, wherein the corner reinforcing step further comprises the step of:

adding multiple additional layers of fabric to all corners.

21. The method of claim 20, wherein the multiple layers of fabric comprise each underlying fabric gore overlapping its adjacent gore in a controlled and tapering manner so that as the fabric approaches the wing corner, wider and more fabric overlaps occur.

22. The method of claim 20, wherein the multiple layers of fabric are rectangular pieces identical in size.

23. The method of claim 20, wherein the multiple layers of fabric are multiple arcs of circular pieces with decreasing radiuses.

24. The method of claim 23, wherein the fabric is progressively heavier or stronger.

25. The method of claims 21, 22, 23, or 24 wherein the corner attachment points comprise webbing straps consisting of suitably sized nylon, polyester aramid, or other polymer, or metal rings.

26. A method of constructing the aerodynamic means of claim 1 or the wing of claim 11, the method comprising the steps of:

providing a form structure for the desired shape of the aerodynamic means or wing;

applying cast-in-place material to the form structure;

allowing the material to set to the desired shape of the aerodynamic means or wing;

reinforcing the edges of the resulting structure of the aerodynamic means or wing;

reinforcing the corners of the resulting structure of the aerodynamic means or wing;

providing attachment points at the corners;

providing reinforcement patches as necessary for attachment of launching/retrieval lines; and

trimming any excess material to conform to the desired shape of the aerodynamic means or wing.

27. The method of claim 26, wherein the cast-in-place material consists of metal and polymer.

28. The method of claims 19 or 26, wherein the wingtips of the aerodynamic means or wing are arranged such that 70 - 80 percent of the total pull of the aerodynamic means or wing is applied to the wingtips and 20 - 30 percent of the total pull of the aerodynamic means or wing is applied to the tail.

29. The method of claims 19 or 26, wherein the wingtips of the aerodynamic means or wing are arranged such that 0 - 50 percent of the total pull of the aerodynamic means or wing is applied to the wingtips and 0 - 50 percent of the total pull of the aerodynamic means or wing is applied to the tail.

30. The method of claims 19 or 26, wherein the aerodynamic means or wing comprises at least two conjoined vaults or lobes of material with a projecting angle, or groin, between the two characteristically running partly or completely along the centerline.

31. An improved apparatus for wind assisted watercraft comprising:

watercraft means comprising sail handling means;

a single layer, inherently stable and powerful light weight, three dimensional wing having a centerline, two wingtips, and a tail corner, and wherein the three dimensional wing further comprises a plurality of gores of predetermined geometries, defining a large diameter self-supporting rolled-over leading edge of an airfoil, a trailing edge, a nose, an inside windward surface, and an outside leeward surface, and wherein the wing profile of the wing approaching the trailing edge exhibits increasing convexity;

two flexible flying lines of predetermined adjustable length each comprising two ends, wherein one flying line end is affixed to a unique point on the periphery of one wingtip and the other end is affixed to the sail handling means, and the other flying line end is affixed to a unique point on the periphery of the other wingtip and the other end is affixed to the sail handling means, and wherein all stresses within the wing resulting from aerodynamic forces, gravity, and transient forces due to inertia are converted into tensile stress within the wing and into pure tension transferred to watercraft means the flying lines.

32. An improved apparatus for wind assisted watercraft comprising:

watercraft means comprising sail handling means;

a single layer, inherently stable and powerful light weight, three dimensional wing having a centerline, two wingtips, and a tail corner, and wherein the three dimensional wing further comprises molded single continuous sheet of material, defining a large diameter self-supporting rolled-over leading edge of an airfoil, a trailing edge, a nose, an inside windward surface, and an outside leeward surface, and wherein the wing

profile of the wing approaching the trailing edge exhibits increasing convexity;

two flexible flying lines of predetermined adjustable length each comprising two ends, wherein one flying line end is affixed to a unique point on the periphery of one wingtip and the other end is affixed to the sail handling means, and the other flying line end is affixed to a unique point on the periphery of the other wingtip and the other end is affixed to the sail handling means, and wherein all stresses within the wing resulting from aerodynamic forces, gravity, and transient forces due to inertia are converted into tensile stress within the wing and into pure tension transferred to watercraft means the flying lines.

33. A method of constructing the aerodynamic means of claim 1 or the wing of claim 11, the method comprising the steps of:

providing a form structure for the desired shape of the aerodynamic means or wing;

laying a thin film of thermoplastic or other film material onto the form;

laying thin strands or "tows", "straps" or "bands" of uni-directional, high-modulus fiber across the film layer on the form;

adding a resin-type material to the strand layer;

laying a further thermoplastic film or other film material on top of the resin-type material;

heat treating the multiple layers to make a monolithic structure conforming to the shape of the form, under pressure;

providing attachment points at the corners; and

trimming any excess material to conform to the desired shape of the aerodynamic means or wing.

34. An emergency method for eliminating all power and retrieving the aerodynamic means of claim 1 or the wing of claims 11, 31, or 32, the method comprising the steps of:

making all flying lines and launch/retrieval lines slack through lengthening, releasing or even cutting them; and

retrieving the aerodynamic means or wing via the tail line(s).